

**APPENDIX D**

**LPGAC Vendor Design  
Information**

**Wheelabrator Westates  
Information**



2130 Leo Avenue  
Los Angeles, CA 90040  
Tel. 213-722-7500  
Fax 213-722-8207

November 11, 1994

Gerhard Panuschka  
URS Consultants, Inc.  
2710 Gateway Oaks Drive  
Suite 250 North  
Sacramento, CA. 95834

Post-It™ brand fax transmittal memo 7671		# of pages > 22
To: Gerhard Panuschka	From: S. M. + 61	
Co.	Co.	
Dept.	Phone #	
Fax # 916-929-7263	Fax #	

Re: San Bernadino, Newmark Superfund Site

Dear Gerhard:

We have run the GAC usage based on the PCE and TCE and predict carbon usage rates at ~~100 lbs per day~~ based on the attached concentrations and flow rate of ~~5000 gpm~~ based on 15 min retention time (cons).

For the flow rate, we would provide ~~2x LPHP-20 dual vessel HP-20 carbon adsorption systems~~. Each vessel would contain ~~20,000 lbs GAC~~ for a ~~total of 40,000 pounds GAC~~.

We offer the LPHP system due to the fact that the City of San Bernadino, as do other municipalities, attempt to have equipment provided that is "low profile" in size.

#### BUDGETARY COSTS:

~~Each LPHP-20 dual vessel system as per above and our attached specifications (available on request) is:~~

Budget:

**\$185,000.00 EACH LPHP20**

→ \$ 225,000 (at 15 min ret. time)

Please note that we could put less carbon into the system to reduce the initial capital costs, if URS believes the contamination level to be based on the actual numbers attached.

#### SERVICE:

~~Service changeout, replacement of the spent carbon with~~ ~~30,000 lbs of carbon~~ ~~and~~ ~~replacement of the spent carbon at~~ Parker, AZ.

Budget per 20,000# adsorber: **\$ 20,000.00**

(Due to labor, transportation costs, etc. please contact us if you request a quote on less carbon per unit, as the dollar per pound will not be the same as per above)

Page 2

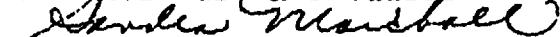
VP GAC only? Need cost!

Since you already have costs on a steam regenerative system I am not waiting for that information from our engineering staff in Illinois that designs those systems. I would state that the budget numbers that you have would be reasonable and within our guidelines for the same type of system.

If you have any questions pertaining to the attached information, please contact me or Bill Edwards, Engineer at 800-659-1771. Thank you Gerhard for contacting Westates.

Sincerely,

Westates Carbon Products

  
Sandra R. Marshall  
Business Development Manager

cc: File  
B. Edwards

(Hard Copy to follow via Fed Express to arrive Monday)

\*\*\* OFFICE COPY \*\*\*

WESTATES CARBON, INC.  
2130 LEO AVE.  
LOS ANGELES, CA. 90040-1634  
(213) 722-7500

ISOTHERM REPORT CREATED ON 11/11/94 AT 11:58 BY  
CUSTOMER: URS Engineers

(Newmark Project)

# LIQUID PHASE DESIGN PARAMETERS

\*\*\*\*\*

Total Flow of Water [gpm] ..... 5000.000

## LIQUID PHASE DESIGN

\*\*\*\*\*

Component	Conc [ppm]	Q [WT %]	#GAC/1000 gal water	Suitability [ppm]
ETHENE, TETRACHLORO- (PCE)	.0350	2.5018	.012	in Range
ETHENE, TRICHLORO- (TCE)	.0070	.5160	.011	in Range 1080

## TOTAL CARBON NEEDED

\*\*\*\*\*

137.28 #GAC/1000 gal water

.04 #GAC/1000 gal water

287.28  
5000 (1440)  
1000

(BOTH TOTALS HAVE BEEN MULTIPLIED  
BY A FACTOR OF 1.0)

45.13 lbs GAC/lb VOC

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WESTATES CARBON, INC.  
2130 LEO AVE.  
LOS ANGELES, CA. 90040-1634  
(213) 722-7500

ISOTHERM REPORT CREATED ON 11/11/94 AT 11:47 BY srm  
CUSTOMER: newmark site

## LIQUID PHASE DESIGN PARAMETERS

\*\*\*\*\*

Total Flow of Water [gpm] ..... 5000.000

## LIQUID PHASE DESIGN

\*\*\*\*\*

Component	Conc [ppm]	Q [WT %]	#GAC/1000 gal water	Suitability [ppm]
ETHENE, TETRACHLORO- (PCE)	.0350	2.5018	.012	In Range
ETHENE, TRICHLORO- (TCE)	.0070	.5160	.011	Min : .0080
ETHENE, cis-1,2-DICHLORO-	.0030	.0450	.055	In Range
CHLOROFORM	.0004	.0051	.064	Min : .0100
ETHANE, CHLORO-	.0004	.0000	9.490	Min : .1000
METHYLENE CHLORIDE	.0002	.0002	.954	Min : .0080
TOLUENE	.0020	.6703	.002	In Range
FREON 113 (CALC)	.0510	8.8113	.005	Min : .1000

## TOTAL CARBON NEEDED

\*\*\*\*\*

~~18.54~~ #GAC/day

18.54 #GAC/1000 gal water

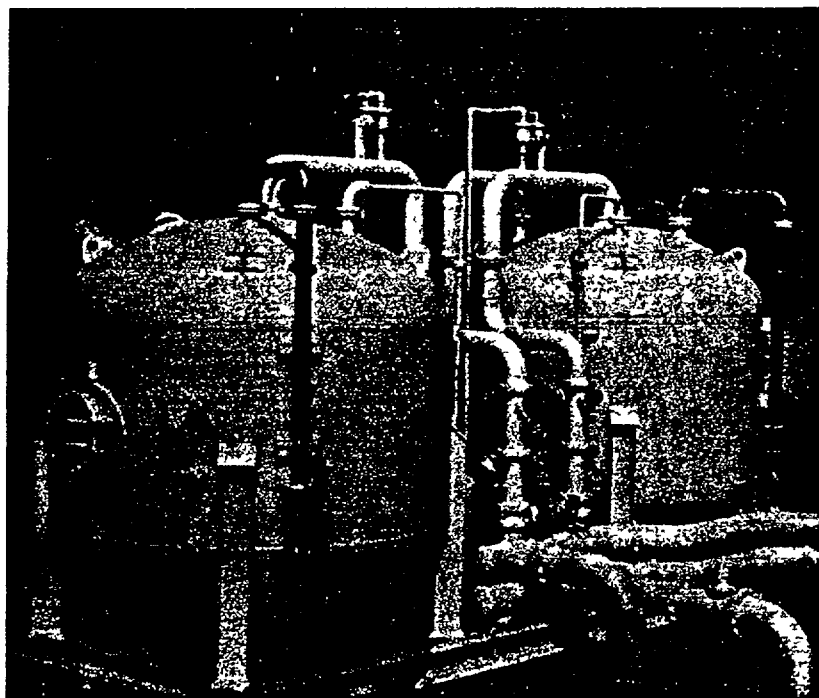
(BOTH TOTALS HAVE BEEN MULTIPLIED  
BY A FACTOR OF 1.75)

Note: This scenario assumes that all compounds have to be removed to ND. In reality, the MCLs will be the influencing factor.

# HIGH PRESSURE™

Engineered  
Water  
Systems

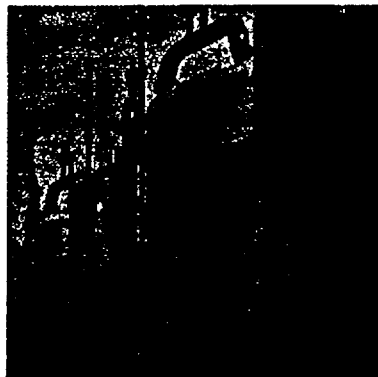
**Shop-fabricated  
and skid-mounted  
for rapid installation.**



## **Economic two-stage GAC systems handle large- scale water treatment applications.**

To keep field installation costs at an absolute minimum, our completely pre-engineered and pre-piped high-pressure systems can be up and running within a week of delivery.

Ideally suited for industrial and municipal applications with high flow rates and low level concentrations of organics, these modular, integrally functional units are designed to significantly reduce operation and maintenance expense.



For optimum service and longevity, sample ports permit monitoring of bed-life for expected break-through, while tank interiors are 100% coated to prevent corrosion.

## **Unique stainless steel underdrain system.**

Unlike other systems that have false bottoms and plastic parts which are inherently susceptible to failure from the effects of mechanical stress and erosion, our proprietary underdrain is specially designed to virtually eliminate use of complex vessel internals.

It permits the influent stream to flow through the bed while retaining carbon, and its stainless steel septas provide for greater strength, more efficient use of media, excellent media retention, and minimal obstruction during carbon removal.

Now, the combined strengths of Westates and Adsorption Systems, Inc. (ASI) make WCAS the leader in design and construction of GAC systems for groundwater, wastewater and potable water treatment. We also provide ongoing carbon analysis, exchange and spent carbon reactivation. This full-service capability affords clients the convenience and economy of a single-source supplier.

For details, contact your WCAS representative or call 800 659-1771.

 **Wheelabrator Clean Air Systems Inc.**  
Westates Carbon Products

## Standard pre-engineered high-pressure systems

All WCAS model HP-10 and HP-20 series consist of dual vessels, complete with inlet distribution, underdrain collection system, and face piping for series lead/lag and parallel flow configuration.

### Material of Construction

Carbon steel—ASME Code Section VII, Div. 1

### External Surface

Epoxy coating – 6 mil DFT

### Internal Surface

Plasite 4110 vinyl ester 35-40 mil DFT – FDA approved

### Vessel Supports

Structural steel legs and skid

### Underdrain System

316 stainless steel vertical screens

### Access Opening

20" hinged manway

### Carbon Fill/Removal

4" flange

### Backwash

Manual

### Auxillaries (Included)

Pressure gauges, sample taps, bed sample port and spray nozzle

### Process Valve

Epoxy-coated cast iron

### QAC Fill/Discharge

Stainless steel full-bore ball

## Specifications<sup>1</sup>

	HP-10-100	HP-10-250	HP-20-11-400	HP-20-11-700 <sup>700</sup>
Overall Dimensions:				
Height	234"	234"	168"	168"
Width	198"	198"	312"	312"
Depth	132"	132"	168"	168"
Vessel Diameter	90"	90"	132"	132"
Straight Side	96"	96"	84"	84"
Face Piping <sup>1</sup>	2"	3"	4"	6"
Flanged Inlet/Outlet	2"	3"	4"	6"
Flanged Carbon Fill/Removal	4"	4"	4"	4"
Flanged Backwash/Vent	2"	3"	4"	6"
Approx. Shipping Weight (lbs.)	40,000	40,000	45,000	48,000
Approx. Operating Weight (lbs.)	100,000	100,000	250,000	253,000

<sup>1</sup>Add the letter "C" after each model number to order face piping with Sch. 40 carbon steel construction. Add the letter "P" for Sch. 80 PVC construction.

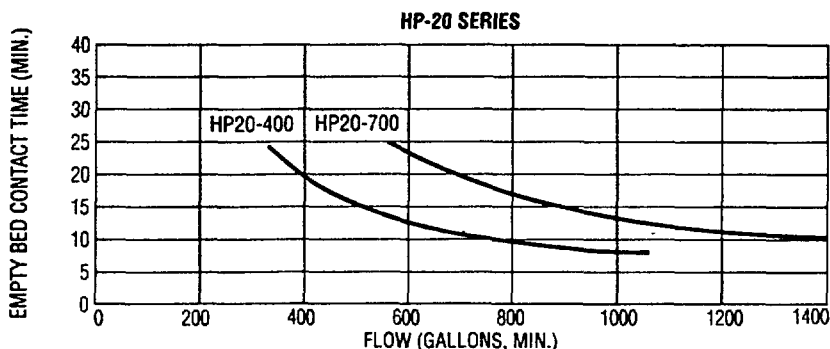
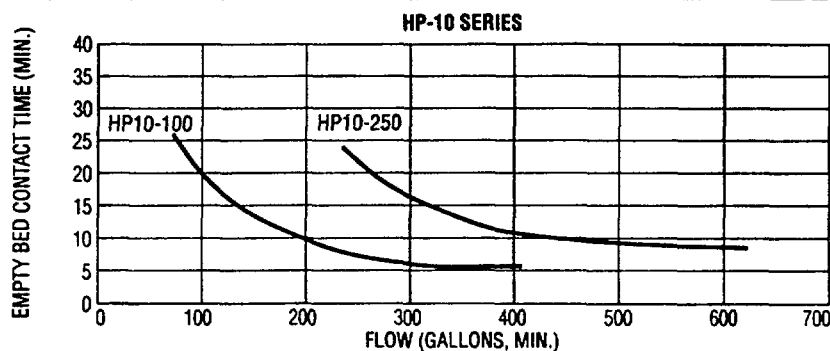
## Operating Specifications

Series GPM (max. @ 8-10 PSID @ 20 min. EBCT) <sup>2</sup>	100	250	400	700
Parallel GPM (max. @ 4-5 PSID @ 10 min. EBCT) <sup>2</sup>	200	500	800	1400
Design Working Pressure (psig) @ 150°F.	75	75	75	75

<sup>2</sup>EBCT (Empty Bed Contact Time) based on a carbon density of 28.0 lb/cu. ft.

Note: For assistance in selecting the proper carbon for your application, contact your WCAS representative.

## EBCT vs. Flow



All information presented herein is believed reliable and in accordance with accepted engineering practice. Wheelabrator makes no warranties as to completeness of information. Users are responsible for evaluating individual product suitability for specific applications. Wheelabrator assumes no liability whatsoever for any special, indirect or consequential damages arising from the sale, resale or misuse of its products.



**Wheelabrator Clean Air Systems Inc.**  
**Westates Carbon Products**

2130 Leo Avenue, Los Angeles, California 90040-1635 213 722-7500 Fax 213 722-8207

# **TECHNICAL SPECIFICATIONS**

**FOR**

- **TWO-STAGE LOW PROFILE  
DISH BOTTOM/DISH TOP  
ACTIVATED CARBON ADSORPTION SYSTEM  
WESTATES MODEL LPHP-20**
- **INITIAL VIRGIN CARBON FILL**
- **SPENT CARBON REACTIVATION**

**BY**



**WHEELABRATOR ENGINEERED SYSTEMS INC.  
WATER PROCESS DIVISION  
WESTATES CARBON PRODUCTS**

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### Appendix

- 1.0 P&ID
- 2.0 Virgin Carbon Fill Specifications

## 1.0 INTENT

The following specifications describes all equipment materials and services to supply, deliver and start-up seven (7) completely shop fabricated skid mounted granular activated carbon adsorption systems. Each adsorber system will be, hereinafter, referred to as the "system". The system must be designed for ease of installation, economical carbon use, ease of carbon loading and unloading utilizing bulk trailers as well embody features that will result in a mechanically reliable system from an operation and maintenance standpoint.

The system supplier must take complete responsibility for the design, procurement, shop fabrication, delivery, start-up and training of the client's personnel as well as provide construction guidance during off-loading and installation of the system (by others). In addition the system supplier must have the inherent corporate capabilities of delivering carbon to the system and removing carbon for off-site thermal reactivation in a "segregated mode". In no event will the supplier perform reactivation services in any other mode other than segregated reactivation thereby ensuring that client's carbon is not mixed with foreign carbons prior to or after reactivation.

## **2.0 SPECIFICATIONS INCLUDE**

- 2.1 Granular Activated Carbon Adsorber Vessels and Related Equipment
- 2.2 Virgin Granular Activated Carbon for Initial Filling of All Adsorber Vessels
- 2.3 Removal, Transportation and Recycling of Spent Granular Activated Carbon by Thermal Off-Site Reactivation In a "Segregated Mode"

### 3.0 WORK INCLUDED

The design, shop fabrication, delivery, installation supervision work and start-up services work to be performed by the supplier shall include the following: Please refer to attached P&ID which represents suppliers scope of work.

- 3.1 Detailed design drawings, bill of materials for major equipment, specifications, operating and maintenance manuals and recommended spare parts. Two (2) complete sets of drawings and O&M's will be provided.
- 3.2 Shop fabrication of two (2) ASME code internally lined dish bottom/dish top adsorbers per system capable of processing up to a maximum flowrate of 750 GPM in the downflow series mode. The adsorbers will be furnished complete with underdrain internals, linings, manway and specified nozzles. The exterior of the vessel will be primed and painted as specified.
- 3.3 One structural steel support skid, primed and painted to support the two (2) adsorbers and integral process, utility (air and water) and carbon transfer piping.
- 3.4 The necessary process piping will include all valves and controls to enable the adsorbers to be operated in the downflow cyclic series or parallel mode. All process piping will be Sch. 40 carbon steel. Ferrous piping and surfaces will be painted. All lines and valves to be labelled and tagged. The piping is to be shop assembled integral with the adsorbers and mounted on a structural steel skid for delivery to jobsite as an integrally complete system.
- 3.5 Independent granular activated carbon fill and discharge piping will be Sch. 10 304L stainless steel complete with valves and associated integral water flush points to enable efficient and complete flushing of the carbon transfer lines during the transfer process. The carbon transfer piping will be shop fabricated and assembled on the adsorbers prior to shipment. \* One (1) twenty-five (25) foot section of four (4") carbon transfer hose with a quick connect sight glass assembly. (\*OPTIONAL)
- 3.6 Adsorber vent, safety relief and sample piping. As a minimum, each adsorber will be provided with one (1) bed sample port located at 80% of the bed depth and sample ports will also be provided on the influent to and effluent from each adsorber.
- 3.7 Utility air piping comprising of compressed air connection piping complete with check valve, shut off valve and hose connectors as is necessary to ensure the supply of air to the adsorbers and to the carbon trailers. \* One (1) air utility hose station with 50 feet of  $\frac{3}{4}$ " hose will be provided with the system. (\*OPTIONAL)

- 3.8 Utility plant water piping comprising of water distribution piping complete with valves, strainer, gauges as is necessary to ensure the supply of utility water to the spray nozzle at the apex of the top dish of each adsorber as well as water to slurry incoming loads of dry carbon to enable transfer of carbon on a slurry to the adsorbers. One (1) water utility station for general utility purposes will be supplied with the system.
- 3.9 Water flush points comprising of valves and hose connects as is necessary to ensure the supply of water in adequate quantities under adequate pressure to the carbon inlet and outlet lines from each adsorber via  $\frac{3}{4}$ " flexible hose.
- 3.10 Backwash supply piping and backwash return piping is necessary to enable the supply of either clean or treated water to the adsorbers in the event of the need to remove solids or gas pockets from the granular carbon bed.
- 3.11 Drain piping from the system to collect fugitive liquid emissions from the system such as truck blow down water, adsorber relief water, vent line overflow, backwash return water.
- 3.12 Effluent piping from the system will comprise of a backpressure regulator to prevent draining of the adsorbers in the event that the influent to the system is shut off. The backpressure regulator will maintain a constant 7 psig backpressure during operations and will completely close during no flow conditions.
- 3.13 Construction supervisory assistance during off-loading and installation of system by client.
- 3.14 Supervisory assistance during hydrostatic testing, start-up and training of client's representatives in system operation.
- 3.15 All labor and technical supervision during the initial fill of carbon and training of client's representatives in carbon fill operations.
- 3.16 The supply and delivery of forty thousand (40,000) pounds of virgin carbon in bulk trailer for "initial fill" into each system.
- 3.17 The removal, transportation, segregated reactivation and return for reuse of carbon in 20,000 pound quantities to maintain two bed process continuity.
- 3.18 Supplier will provide technical training to client's operating personnel during the first carbon replacement protocol.

#### **4.0 WORK NOT INCLUDED**

The following work is not covered by this specification and is to be the responsibility of client or others. Supplier will however provide such information as is required to enable the client to complete their responsibilities.

- 4.1 Foundations, truck access, spill containment, site drainage and area lighting.
- 4.2 Off loading and installation of delivered systems on client prepared foundations including tightening of any loose connections to correct minor leaks during hydrostatic testing and effecting minor touch up painting of factory finished surfaces impacted during installation with "touch up paint" furnished by supplier.
- 4.3 All appurtenances as required to deliver the metered influent under pressure and specified utilities (air and water) to the system and conveying the effluent from the system.
- 4.4 All appurtenances as required to supply backwash water to system and convey, collect and retreat backwash return water, truck blowdown water and fugitive emissions from the system.
- 4.5 Pretreatment and post-treatment before and after the carbon adsorption system if so required.
- 4.6 Anchor bolts shimming and grouting as required to level and to secure skid to foundation.
- 4.7 System enclosure for freeze and inclement weather protection.
- 4.8 Operation, monitoring (sampling and analytical testing) and maintenance of system and purchase of recommended spare parts.
- 4.9 Permits and licenses that may be required to build and operate system.
- 4.10 Categorization of spent carbon as either non-hazardous or manifested under RCRA including completion of all forms and manifests as may be required to ensure compliance with all applicable local, state and federal regulations.

## 5.0 DEFINITIONS AND ABBREVIATIONS

Wherever in these specifications or in other contract documents the following terms are used, the intent and meaning shall be interpreted as specified herein.

ANSI	American National Standards Institute
ASME:	American Society of Mechanical Engineers
US EPA:	US Environmental Protection Agency
GPM:	Gallons per Minute
GPD:	Gallons per Day
PSIG:	Pounds per Square Inch Gauge (Absolute Pressure minus Atmospheric Pressure)
RCRA:	US Resource Conservation and Recovery Act
Influent:	Composite liquid stream entering the adsorption system
Effluent:	Composite liquid exiting the adsorption system after treatment
System:	The granular activated carbon system as specified herein and which system will be manufactured out of "new material"
Virgin Carbon:	Granular activated carbon newly manufactured from new materials and which was not previously used, or manufactured by reactivation of used material
Spent Carbon:	Granular activated carbon used in the adsorber vessels that has reached its adsorptive capacity and which may be defined as hazardous by federal and/or local regulations.
Reactivation:	The process wherein the spent carbon's adsorptive properties are restored through thermal means and which process will isolate and reactivate the client's carbon in a segregated mode to maintain its individual identity.

## **6.0 DESIGN REQUIREMENTS**

### **6.1 General**

The system shall be used for the treatment of groundwater.

### **6.2 Influent Quality**

Results of laboratory analysis of influent characterizing the pH, solids, inorganic and organic constituents are to be supplied by client. System is to be designed to remove \_\_\_\_\_.

### **6.3 System Flow Capacity**

The system shall have a maximum design hydraulic capacity of up to 1500 GPM with a flow of 750 GPM through each adsorber.

### **6.4 Contact Time**

The contact time in each adsorber vessel will be not less than 7.12 minutes at a maximum design flow rate of 750 GPM, in the parallel mode. The total contact time with two (2) beds in series service shall be 14.24 minutes at the maximum flow rate.

### **6.5 Flow Mode**

The two (2) adsorbers will operate in the cyclic series or parallel downflow mode. The adsorber will be designated as VA-VB. Staging sequence will be VA-VB, VB-VA.

### **6.6 Adsorber Carbon Capacity**

Each adsorber vessel shall have a granular carbon capacity of not less than 20,000 pounds of virgin carbon. Each adsorber will provide for additional freeboard above the bed of no less than 30% of the volume of the carbon bed.

### **6.7 Pressure Drop**

Pressure drop across the system shall be limited to 10 PSIG (including system piping, underdrains and carbon) when operated at the system capacity in the series mode with all adsorber vessels in service with clean carbon beds.

#### 6.8 Adsorber Vessel Diameter

Adsorber vessels shall have an outside diameter of no less than 11.5 feet with a dish top and dish bottom straight side height of no less than 5.0 feet as measured from tangent to tangent.

#### 6.9 Design and Operating Pressure

Adsorber vessels, piping and appurtenances subject to internal pressure during normal operation, backwashing (reverse normal flow direction) or granular activated carbon filling or removal shall be designed for pressure of not less than 125 PSIG at 150°F. Normal supply pressure to the groundwater connection to the system will be approximately 40-50 PSIG. Vessels shall be ASME code national board stamped.

#### 6.10 System Dimensions, Shipping and Weights

The two stage skid mounted system shall be shipped to the jobsite on a double drop deck trailer and shall be capable of being offloaded by client utilizing lifting lugs on the systems. The overall system dimensions when installed shall not exceed 30'L x 14'W x 14'H and will have a shipping weight of no greater than 48,000 pounds. The operating weight of the system on a flooded basis with 40,000 pounds of installed carbon will be approximately 250,000 pounds.

#### 6.11 Mode of Operation

System shall be designed for operating in the series or parallel downflow mode, with the influent processed through the adsorbers and directed to one treated water connection after the antisiphon loop to enable client to convey effluent to outfall. Likewise one influent connection will be provided for client tie-in. The system shall also be capable of operating in the backwash mode wherein an adsorber vessel is isolated from the influent and plant water and/or treated water is introduced flowing upward through the bed and out to the backwash return header. The vessel internals must be capable of withstanding 75 PSIG during backwash operation.

#### 6.12 General Process Description

The adsorption system utilizes granular activated carbon for efficient removal of dissolved organic contaminants from liquid streams. Adsorption is a physical process in which the compounds adhere to the surface of the carbon particle. The large surface area contained within the internal pore structure of the carbon provides the carbon adsorption system with substantial capacity for organic compounds to be removed. The adsorption system provides effective exposure of the contaminated water to a quantity of granular activated carbon.

Influent will be pumped under pressure at a controlled and metered rate, by client, to the adsorption system and will enter the vessels at the top and flow downwards through the carbon beds. Specially designed external screens shall be provided to collect the treated water and retain the granular media in the bed. The treated water is discharged from the adsorber through external effluent piping.

The adsorption system is placed into service with two (2) beds in the processing mode. After a period of time as determined through sampling and analysis, the effluent from the 80% bed depth sample point of second or polish bed will approach breakpoint (that point at which the effluent criteria is just about to be exceeded). At this point the first or lead adsorber is removed from service and the flow is directed to the polish bed while preparations are made to effect carbon removal for reactivation and reuse.

The spent adsorber is pressurized with compressed air (50 PSIG - 60 PSIG) and the spent carbon is displaced into a spent return trailer. The spray nozzle at the apex of the top dish is activated to ensure that complete removal of the spent carbon is possible in a single operating sequence. The transfer hose sight glass as well as the quick opening round manway can be used as additional checks to ensure that the adsorber is empty of its contents. The spent carbon is pressure dewatered in the trailer utilizing 15 PSIG @ 150 SCFM air from the system and the step down regulator on the trailer and the water drained from the trailer is directed to the truck blowdown connection on the system utilizing the 4" hose supplied with the system. The spent carbon is transported for off site reactivation and is then returned for reuse in the system at the next scheduled transfer. During the reactivation process the system is operating with two beds in service.

After the adsorber has been recharged, the adsorber is placed in service in the polish mode. Each changeout (removal of spent carbon and reloading with fresh carbon) shall be accomplished by pneumatic displacement of the carbon in slurry form utilizing bulk trailers and with minimal human contact, in a closed loop piping system in order to minimize environmental exposure.

## 7.0 EQUIPMENT SPECIFICATIONS

### 7.1 Adsorber Vessels

A total of two (2) adsorbers shall be supplied. Each adsorber shall be a vertical cylindrical flanged and dished bottom head pressure vessel with a flanged and dished top head. Each adsorber vessel shall be designed to contain 20,000 pounds of 8 x 30 mesh virgin granular activated carbon with freeboard above the bed. The freeboard shall be no less than 30% of the volume of the carbon. The vessels shall be constructed of SA-516 grade 70 pressure vessel quality carbon steel plate and shall be designed, constructed, tested, certified and stamped in accordance with the most recent revision of the ASME boiler and pressure vessel code, Section VIII. The design pressure rating of the vessel shall be 125 PSIG at 150 degrees fahrenheit. The vessel shall be supported by four (4) w8 x 31# structural steel legs with drilled base plates such that the vessels can be adequately and safely bolted to a structural steel skid. The interior surfaces of the vessel shall have all welds and any other sharp edges ground smooth and all imperfections such as skip welds, delaminations, scabs, slivers, and slag shall be corrected prior to lining. All welds will be ground to a radius compatible to the lining and shall be free of porosity and vessel interior preparation shall conform to nace specification. The vessel diameter shall be 11.5 feet and will have a straight shell height of no less than 5.0 feet.

### 7.2 Adsorber Interior Lining

The interior of each adsorber vessel shall be lined in order to prevent corrosion that will occur when wet GAC is in contact with carbon steel. This lining shall exhibit abrasion resistant qualities to prevent erosion by movement of the granular media. The coating shall be as manufactured by Wisconsin Protective Coatings Plasite 4110 with a nominal dry film finished thickness of between 35-45 mils.

Prior to application of the lining the adsorber interior surface shall have all welds and any other sharp edges ground smooth and all imperfections such as skip welds, delaminations, scabs, slivers and slag corrected prior to abrasive blasting. Sharp edges and fillets shall be ground to a smooth radius of at least 1/8". The adsorber internal surface including all nozzles shall be blasted a white metal surface (SSPC-SP5) to provide an anchor pattern in the metal corresponding to approximately 20%-25% of the film thickness of the coating. All wetted surfaces will be lined with Plasite 4110.

#### 7.2.1 Preparation and Storage

Preparation of the coating material shall be in strict accordance with the manufacturer's instruction and shall be thoroughly mixed and, if necessary, shall be thinned before applying.

Coating materials and thinners shall be stored in tightly closed containers and kept in a well ventilated, cool storage shed or room as recommended by the manufacturer.

### 7.2.2 Application

- The coating materials shall be applied in strict accordance with the manufacturer recommendation and shall be done by qualified workmen experienced in this particular type of work.
- Cleaned surfaces must be kept completely dry prior to the coating operation. No prepared surface shall be left uncoated for more than 24 hours.
- Coating application shall be performed as a two-coat spraying operation by means of which a 20 mil dry film thickness shall be attained per coat. The spraying procedure shall be in accordance with the manufacturer's instructions.
- No coating work shall be performed during weather which is not in accordance with the manufacturer's instructions.
- Coating shall be applied at ambient temperatures as specified by the manufacturer.
- *Coated faces of flanges must be smooth and flat with no bumps or indentations.*
- Wiping cloths, waste and similar materials which have become soiled or soaked with coating compound and thinners shall be placed in tightly closed containers or otherwise properly disposed of to eliminate danger of spontaneous combustion.

### 7.2.3 Safety

- The coating system may be handled safely by trained personnel following normal laboratory and plant standards for good housekeeping and personal hygiene. In the event of skin contact complications, the affected areas should be washed with soap and water. Eye protection is recommended. Work shall be performed in well ventilated areas away from an open flame and when in enclosed areas, although ventilated, fresh air masks should be provided.
- The catalyst or curing agent is relatively stable at room temperature but must be protected from contamination, heat and fire and is classified by the interstate commerce commission as an "oxidizing material" and subsequently all shipping containers bear a yellow caution label. The catalyst is highly irritating if it gets into the eyes. Immediately rinse eyes thoroughly with water and get medical attention. The catalyst also can be a skin irritant and this should be removed with large quantities of soap and water. Since this is an oxidizing material, it should not be allowed to accumulate or remain in soaked rags or clothing.

#### 7.2.4 Inspection and Testing

The completed coating shall be inspected by a qualified inspector and shall be checked for the following:

- Check for soft spots, blisters, white spots, damaged areas, rough and uneven flange facings and other visible defects.
- Check dry film thickness of coating by means of a General Electric Model Type B, or equal, dry film gage. Make at least one measurement for each sq. ft. Of surface. All areas with less than 30 mil dft must have additional lining sprayed on before spark test. Run thickness test prior to spark test.
- Spark test for pinholes with A4500 VDC detector on all coated surfaces. A tinker and razor Model AP-W, or equivalent device, is required for this operation. The lining must have a 48 hour minimum cure time of 70 degree F before the spark test is run. Test shall be made at 3000 to 3500 volts maximum.
- Upon completion of the inspection and testing, all defects noted shall be repaired to the client's satisfaction.

#### 7.3 Exterior Paint for Ferrous Surfaces

All ferrous surfaces such as carbon steel pipe, structural steel skid and pipe supports shall be sandblasted in accordance with SSPC-SP-6 commercial blast to provide a rust free and scale free surface and a .5-3 mil blast profile. Prepared surfaces will be painted with Carboline 801 self priming high build semi glass two component cross linked epoxy paint in accordance with Carboline manufacturer's product data for applications procedures. The finished dry film thickness shall be between 4-6 mils DFT. All ferrous surfaces shall be painted a uniform color with color to be specified by client from standard and readily available color as specified by Carboline color selector chart.

#### 7.4 Adsorber Underdrain

There shall be a collection system in the dish bottom section of the carbon bed to collect treated waste across the carbon bed cross section. The water velocity profile across the diameter of each bed shall be uniform in the downward direction of the underdrain location. The collection device shall comprise of eight (8) 316L stainless steel screens. The screens shall be designed such that they can be removed without entering the vessel. The screens will be designed to retain carbon and allow free passage of treated water to be directed at minimum pressure drop to the 6" external collection header from which the treated water will be conveyed via piping to the second stage adsorber. All adsorbers will be provided with the identical underdrain design.

In no case will material foreign to carbon, i.e.: sand, gravel or concrete be installed inside the vessel to assist in treated water collection underdrain. Designs incorporating plastic pipes, plastic distribution nozzles and laterals with support plates and screens within the vessel will not be considered due to the risk of underdrain failure and the substantial costs to client that would result in such failure. The suppliers underdrain must demonstrate through design and warranty that every effort has been made to minimize vessel internals and that such internals are structurally sound and capable of withstanding the pressure exerted during backwashing and carbon transfer operations.

Designs incorporating alternate internals underdrain arrangements must at a minimum utilize all 316L stainless steel distributors, with 316L stainless steel couplings and 316L stainless steel internal supports and Sch. 40 316L stainless steel pipe for header and distribution laterals. Compression fittings and plastic distributors will not be considered, due to risk of failure from hydraulic shock, erosion and poor wear characteristics.

#### 7.5 Adsorber Manway and Nozzles

##### 7.5.1 Manway

Each adsorber shall be provided with one (1) manway located on the vessel shell just above the point where the dish bottom section connects with the vessel straight side (above tangent line). The manway shall be a 20" quick opening Tube Turn manway with EPDM saline closure type gasket and zinc plated swing bolts with zinc plated nuts and washer. The quick opening feature will enable client to inspect vessel after spent carbon transfer to ensure that vessel is completely empty. Round bolted manways will not be permissible due to the time and expense involved with opening and closure.

### 7.5.2 Nozzles

Each vessel shall be provided with at a minimum the following nozzles:

- Six (6) inch diameter ground water (influent) inlet on the top of the adsorber
- Six (6) inch diameter inlet for virgin granular activated carbon on the top (see note 1)
- Six (6) inch diameter combination backwash return/vent/relief outlet on the top of the adsorber
- Four (4) inch diameter inlet for spray nozzle insert at the apex of the top dish (see note 3)
- A six (6) inch diameter spent granular carbon outlet on the bottom (see note 1)
- Eight (8) - 6" diameter nozzles for treated water outlet/on the bottom head of the adsorber
- One (1) - 2" diameter nozzle on the vessel shell for monitoring performance of the 80% bed depth of each adsorber (see note 2)

NOTE 1: This nozzle has been designed to incorporate an abrasion resistant insert that will protect the lining from deterioration during carbon transfers.

NOTE 2: This nozzle has been sized to enable the insertion of a one (1) foot long flanged sample probe to enable extraction of a liquid sample at 80% of the vertical bed depths in the direction of flow.

Nozzles shall be flush with the inside of the vessel shell and be provided with 150 pound flat face flanges on the vessel shell.

NOTE 3: This nozzle has been sized to enable the insertion of a one (1) foot long 304L Sch. 40 spray nozzle insert pipe at the end of which a 2" full cone spray nozzle is coupled.

## 7.6 Adsorber Inserts

### 7.6.1 \*Abrasion Resistant Inserts

The carbon inlet and outlet nozzles on each adsorber shall be equipped with a removable/replaceable abrasion resistant insert to protect the lining at the nozzle from deterioration and wear during carbon slurry transfers to and from the vessel. The insert shall be manufactured out of 4" Sch. 10 316L stainless steel and shall be of the wafer type such that it can be sandwiched between two (2) 6" 150 pound flat face flanges. The insert shall extend into the nozzle and have an overall length of 6" from the face of the flange. Gasketing on either side of the insert shall be 1/8" thick full face EPDM gasket. A total of two (2) inserts will be supplied per vessel. (\*OPTIONAL)

### 7.6.2 Bed Sample Insert

One (1) flanged sample tap nozzle shall be provided along the vertical shell of each adsorber vessel. Sample nozzles shall consist of a 2 inch 150 pound flat face flange. The sample insert shall be a 3/8" diameter pipe 13" long with four (4) inches of the thirteen (13) inch length being a screened section of 0.01" Slot opening 316L wedge wire screen. The other end will be a wafer flange. The insert will be sandwiched between the tank nozzle and a tapped blind flange utilizing 1/8" thick full face EPDM gaskets. The blind flange tap will be 1/2" NPT for connection to 1/2" diameter 316 stainless steel sample tubing equipped with 1/2" NPT regular port 316 stainless steel ball valve.

### 7.6.3 Adsorber Designation and Labels

Each adsorber vessel shall have a stenciled label with a warning sign stating that the vessel interior is lined and that no welding to the vessel will be permitted. The sign shall read:

**"LINED VESSEL"**

**"DO NOT WELD, BURN OR SHOCK"**

Each adsorber shall have a 8 1/2" x 11" mylar laminate over vinyl warning label located adjacent to the manway. The label shall read as follows:

#### **WARNING**

**"DO NOT ENTER WITHOUT AIR SUPPLY MASK OR SELF  
CONTAINED BREATHING APPARATUS. INTERIOR DOES NOT  
CONTAIN ADEQUATE OXYGEN TO SUSTAIN LIFE!"**

## 8.0 PIPING NETWORK

Process piping shall be provided to the two (2) adsorbers to enable the following functions to be performed:

Under normal operation, the maximum design flow of 750 GPM shall be accepted at the system limits and directed to the two (2) adsorbers operating in the two stage series mode. Treated water piping on the skid will incorporate a 6" Sch. 40 carbon steel flanged connection for client tie-in. Lever operated cast iron butterfly valves shall be provided on the skid to enable the sequencing of the adsorbers in the series mode of operation. The valves will enable isolation of any one adsorber while the other is being recharged with fresh carbon. All influent/effluent piping on the skid shall be 6" Sch. 40 carbon steel. The piping oriented such that the two adsorbers can be operated in the parallel mode and either adsorber can be placed in the "lead bed" mode with the second adsorber in the "polish bed" mode.

### 8.1 Adsorber Backwash

The piping shall enable the vessels to be backwashed should an unacceptable pressure drop develop across the carbon bed due to introduction of filterable solids biological activity or gas pockets in the bed. In case of backwash, the vessel being backwashed shall be isolated from the process flow, as during the carbon replacement procedure. Clean plant water can be introduced at a ratio of between 100-120 GPM upflow through the fouled bed. Alternatively the system also permits the utilization of treated water from one adsorber be directed up flow through the other. Furthermore, the system is provided with a 6" 150# flanged connection to enable the introduction of up to 700 GPM of clean organic free water upflow through the adsorbers subject to availability of this water and the client's desire to have this capability. The backwash return water containing particulate impurities upon exiting the top of the adsorber will be directed via backwash returns piping on each adsorber and the system drains header connections from which point client will convey backwash return water to the head of the process for solids removal and retreatment.

### 8.2 Compressed Air Piping and Controls

The piping system will contain the necessary compressed air connections to the adsorbers to enable 60 PSIG air at a flow of 150 SCFM (supplied by either a temporary air compressor or permanent plant air system) to enable the transfer of spent carbon from the adsorber to the truck and for the transfer of fresh carbon from the truck to the adsorber and to enable pressure dewatering of the spent carbon. A hose station for utility air to the truck shall be provided at the air pressurization connection.

Air piping connections will be manufactured out of ¾" Sch. 40 carbon steel with bronze body regular port ball valves and bronze body check valve with ¾" Chicago universal hose coupler. Client will supply air via ¾" compressor hose to the connection.

NB: The carbon trailers will be equipped with step down regulators to enable the supply of 15 PSIG air at 150 SCFM to the trailer for fresh carbon transfers and spent carbon dewatering.

### 8.3 Utility Water Piping

The piping skid will contain the necessary valves and controls to enable the supply of water to backwash the adsorbers, supply water to the adsorber spray nozzles, water to slurry carbon, water to truck connection for fresh carbon transfers, water to provide a "water flush" for the carbon transfer lines and a utility water hose station. All utility water piping shall be manufactured out of 2" Sch. 40 carbon steel with regular port carbon steel ball valves. Client will supply 100-120 GPM @ 60 PSIG water to one connection located on the system.

### 8.4 Interconnecting Process Piping

Supplier of the system shall design, procure and shop fabricate all interconnecting piping integral to the adsorbers as well as the required carbon transfer and utility piping such that the entire system arrives to the job site as a prepiped modular skid mounted assembly.

### 8.5 Utility Water (Water to Truck)

Water will be piped to the truck unloading station. End connections will comprise of a 4" OPW Evertite aluminum male hose adaptor with block and bleed valves to release pressure prior to hose disconnect.

### 8.6 Adsorber Vent Piping

Each adsorber will be provided with a vent system comprising of a vent line with vent valve and rupture disk combination.

### 8.7 Air/Vacuum Release Valves and Piping

In addition each adsorber will be provided with a combination air/vacuum release valve located at the high point of the influent piping to each adsorber to evacuate any free air that could accumulate in the free board volume above the carbon bed. The discharge from the air/vacuum release valves will be rigidly piped to the system drain.

## 8.8 Carbon Transfer Piping

Individual carbon fill and discharge piping shall be shop connected to each adsorber. Piping shall be constructed out of 4" Sch. 10, 304L stainless steel with full port stainless steel ball valves. The transfer piping shall be fitted with 4" OPW Evertite quick disconnect adapters. Carbon fill and transfer lines will be provided with block and bleed valves for line depressurization prior to hose disconnect. \* One (1) portable quick connect sight glass assembly shall be provided to enable observing the movement of carbon in the transfer lines. (\*OPTIONAL)

## 8.9 Water Flush Points

Water flush points will be provided on the carbon transfer piping such that water from the water hose station can be introduced via  $\frac{3}{4}$ " hose to ensure the movement of carbon quickly and with minimal abrasion. Water flush points must be provided by system supplier to clean transfer lines after the loading and unloading process and as a means of eliminating line plugging.

## 8.10 Sample Piping

The following sample taps will be provided as a minimum:

- Influent water to each adsorber
- Treated water from each adsorber
- 80% depth point on each vessel. The influent to each adsorber, treated water from each adsorber and bed depth sample piping shall be  $\frac{1}{2}$ " diameter stainless steel tubing with  $\frac{1}{2}$ " diameter 316 stainless steel ball valves. The bed depth sample lines will be tubed to an accessible location adjacent to each adsorber. Sample taps on the influent and effluent from each adsorber shall be local sample points.

## 8.11 Connections and Utilities by Client

The skid mounted modular adsorption system shall be designed and fabricated to provide single bolting battery limit connections for the client to connect to influent, effluent, utilities, backwash supply and system drain piping. The following connections will be provided by client to the system. Please refer to P&ID.

- Influent from well pump to one (1) - 150 pound flanged 6" connection
- Treated water from one (1) - 150 pound flanged 6" connection after antisiphon loop
- Drain header connection on system will require client to connect to one (1) 150 pound flanged 6" connection and convey water to a foundation sump for reprocessing through system

- 100-120 GPM @ 60 PSIG of water to one (1) 2" 150 pound flanged connection on system
- 1000 GPM @ 20 PSIG of backwash supply water (treated water) to one (1) 150 pound flanged 6" connection
- 150 SCFM @ 60 PSIG of compressed air to be supplied via ¾" compressor hose with chicago type hose couplers from either a temporary compressor or permanent compressor

Note: Please refer P&ID for client connections.

## 8.12 Piping Schedule

Piping material, joint types and test pressures shall be in accordance with the following piping schedule.

Service Pressure	Piping/Size	Joints/Fittings	Test
Compressed Air Connection to Adsorbers and Truck (Air Pressurization Connection)	Carbon Steel Sch. 40 ASTM A120 or A53 ( $\frac{3}{4}$ " ) with $\frac{3}{4}$ " Chicago hose connect block valve and check valve	Screwed, Black Malleable Iron 150# rating	70 PSIG
Water to Truck and Hose Station	Carbon Steel Sch. 40 ASTM A120 or A53, Grade B, ERW (2", $\frac{3}{4}$ " )	Screwed, Black Malleable Iron	60
Water to Spray Nozzle	Carbon Steel Sch. 40 ASTM A120 or A53, Grade B, ERW ( $\frac{3}{4}$ " , 2")	Screwed, Black Malleable Iron	60
Drain, Vent Raw Water, Treated Water, Backwash Return/ Supply	Carbon Steel Sch. 40 ASTM A120 or A53, Grade B, ERW (6")	Butt Welded 150# Rating	60
Granular Activated Carbon Slurry (Spent and Virgin Carbon Piping)	Type 304L Sch. 20S ASTM A312 Grade TP304L (4")	Type 304L Type A Stub End with Carbon Steel A181 Grade 1 150# ANSI Lap Joint Flanges	60
Sample Tubing	Type 316SS $\frac{1}{2}$ " OD 20 BWG	Compression Fittings Parker CPI or Swagelok	60
Alternate Pipe Carbon Slurry Lines (4" inches)	Lined Carbon Steel DOW Chemical Moraf PPL Brand (4")	Flanged 125# ANSI-B16.1 ASTM A126 Class A, Cast Iron Threaded Flat Face Flanged with Plastic Liner Formed over Flanged Face to Form a Molded Raised Face	60
Gaskets	Flat Ring for Raised Face and Full Face for Flat Face Flanges	$\frac{1}{8}$ " EPDM	
Bolts	Standard Hex Head Machine Bolts ASTM A307 Grade B with Heavy Hex Nuts Zinc Plated with Flat Washers and Lock Washers		

### 8.13 Exterior Finish - Steel Surfaces, Piping

All exterior of adsorbers any ferrous piping and structural steel shall be cleaned of oil and grease with Carboline thinner #2 in accordance with SSPC-SP-1. All steel surfaces to be sandblasted in accordance with SSPC-SP5. Prepared surfaces to be painted with Carboline 801 (4-6 mils). Color to be specified by client.

### 8.14 Surfaces to be Excluded from Paint

Surfaces of the following materials shall be not painted: aluminum, brass bronze, copper, stainless steel, chrome plated metals, polish or machined surfaces such as motor shafts, valve stems, etc.; stainless steel, piping and components; insulated or presently-to-be-insulated piping and equipment, and PVC piping and valves.

### 8.15 Pipe/Valve Identification

Pipe identification as to service designation shall be W.H. Brady "Sign Mark" Type B-946 self adhesive label. Directional arrows shall indicate direction of flow. Valve tags corresponding to valve numbers designated in the operating manual shall be secured to each designated valve. The valve tag shall consist of a 1/16" thick laminated plastic plate with 9/16" black or blue characters on both sides on white background. Plate shall be 1 1/4" x 2 1/2" with 1/8" drilled holes. Valve tag shall be affixed to valve with four (4) ply .014 inch copper wire crimped with tamper resistant lead carseal.

## 9.0 PIPING ACCESSORIES

### 9.1 Transfer Hose Connectors: (HC-2)

The granular activated carbon slurry piping shall be fitted with hose connectors, such that carbon transfer to and from the adsorber vessels can be effected with transfer hoses supplied with system. These connectors shall be 4" quick disconnect adapters constructed of aluminum as manufactured by OPW Division of Dover Corporation as Evertite, Part No. 633-A or equal.

#### 9.1.1 Flush Connections (HC-1)

$\frac{3}{4}$ " flush valves upstream and downstream of the 4" carbon slurry valve (four (4) per vessel) shall be provided with a  $\frac{3}{4}$ " stainless steel ball valve and  $\frac{3}{4}$ " quick disconnect adapter, Evertite Part No. 633-F or equal.

#### 9.1.2 Air Pressurization Hose Connection (HC-3)

The air pressurization hose connection to each adsorber shall be a Chicago type universal hose coupler. Dixon Model AM-7 or equal.

#### 9.1.3 \*Sight Glass (Backwash Return) (SG)

One (1) - 6" diameter sight glasses shall be installed on the system drain pipe header for visual observation of backwash water during the "backwash mode" and as a means of determining rupture disk failure. Sight glass shall be of the wafer type with a double wall section. The inside wall shall be acrylic and the outside wall pyrex glass. The sight flow section will consist of polypropylene flange faces with Viton "O" rings. Sight glass to fit between 150# ANSI flanges and will be Plastomatics Model No. GYW600V-PP, with a rating of 40 PSIG at 150 degrees fht. (\*OPTIONAL)

#### 9.1.4 \*Sight Glass Quick Connect Assembly (PSF)

System supplier will furnish one (1) 4" sight glass assembly with quick connect adapters for direct coupling to the carbon transfer lines so as to enable a visual monitoring of the carbon transfer process during loading and unloading of the adsorbers. The quick connect assembly shall comprise of one (1) sight glass Model No. GYW400V-PP sandwiched between one (1) Evertite or equal 4" flanged female hose adaptor and one (1) Evertite or equal flanged male hose adapter. The entire assembly will be supplied with a heavy duty carrying strap. (\*OPTIONAL)

#### 9.1.5 \*Hoses (HZ-1, HZ-2)

Contractor will supply the following hoses with the system:

1. One (1) section of A PVC tigerflex type f carbon slurry hose, being 4" diameter x 25 feet long with 4" Evertite, Part No. 633-C aluminum quick connector on both ends. (HZ-1) (\*OPTIONAL)
2. One (1) section of air/water utility hose Flexline # VF-12 3/4" diameter x 50 feet long with 3/4" Evertite, Part No. 633-C aluminum quick connectors on both ends. (HZ-2) (\*OPTIONAL)

#### 9.1.6 Water to Truck

Water to slurry the carbon for virgin carbon transfers of carbon to the adsorbers shall be provided as a connection off the system plant water piping. Water will be supplied via a 2" carbon steel line with a 2" carbon steel block valve and 4" male Evertite quick disconnect adaptor. A 3/4" NPT regular port bronze hose bleeder valve shall be supplied to bleed line pressure before disconnecting hose.

#### 9.1.7 Hose Stations (Air/Water)

Two (2) hose stations shall be provided on the system piping for "air" and "water". Each hose station shall be provided with a 3/4" block valve, 3/4" male hose connect and 3/4" hose bleeder valve. The air station valves will be 3/4" threaded bronze regular port valves while the water hose station valves shall be threaded 3/4" NPT regular port bronze ball valves.

## 10.0 VALVES

The system supplier shall furnish all valves as specified below.

Butterfly Valves (WV-4) 6"	Flanged gear operated, epoxy coated cast iron body, coated ductile iron disc, with EPDM seat Bray Model No. 30-119
Ball Valve (BV-5) ½", ¾", 2"	Threaded bronze ball valve, hard chrome ball, RTFE Seats, Lever Operated Apollo Model No. 70-103, 70-104, 70-108
Ball Valve (BV-1) - 4"	150# Flanged Fullport 316 SS RTFE Seats, Lever Operated Wesco Model 105RF0910
Ball Valve (BV-2) - ¾"	316 SS Ball, Regular Port, Threaded, Lever Operated, RTFE Seat and Seal Apollo Model 76-104
Ball Valve (BV-3) - ¾"	Threaded Bronze Ball Valve Hard Chrome Ball, RTFE Seats - Lever Operated Apollo Model 70-104
Check Valves (CV-1) - ¾"	Apollo Model 61-104
Check Valves (CV-2) - 2"	Apollo Model 61-108

## 11.0 INSTRUMENTATION AND SPECIALTIES

Pressure Gauge (PI)	4½" Dial, Stainless Steel Bourdon Acrylic Shatterproof Lens, Polypropylene Case, Glycerine Filled, ½" Bottom Connection, 0-100 PSIG Versa - Model 341P
Vessel Relief (RD-1)	4" Graphite Zook Rupture disk Factory Set @ 125 PSIG Burst Pressure
Spray Nozzle (SN)	Bete Model #2NCS2035N 2", 60 Degree Full Cone Polypropylene MNPT 100 GPM @ 60 PSIG
Air/Vacuum Release Valve (CAV)	Apco Combination Air/Vacuum Release Valve Model # 145C. Cast Iron Body, Stainless Steel float Buna N Seat - 2" NPT 150 PSIG @ 150°F
Backpressure Regulating Valve (BPRV)	Claval Model # 92G-01 Pressure Sustaining Valve, 150# Flanged, 3" Size Cast Iron Body Bronze Trim. Adjustment Range 0-75 PSIG Maximum Flow 460 GPM

## **12.0 GRANULAR ACTIVATED CARBON (GENERAL)**

Granular activated carbon furnished and installed for initially filling the adsorber vessels shall be as specified herein.

- The granular activated carbon shall be virgin material manufactured from select grade of bituminous coal only. The activated carbon must possess superior hardness and abrasion characteristics to withstand pneumatic and hydraulic transfers and handling without significant change in physical size or loss of carbon volume.
- The granular activated carbon shall be supplied by system supplier who is experienced in the application of granular activated carbon for the application. A total of 40,000 pounds of virgin carbon will be supplied per system.

### **12.1 Handling Characteristics:**

The granular activated carbon's physical size and density must be such that it shall flow readily within the virgin and spent granular activated carbon transfer piping provided with the system and must form a workable slurry with a concentration of approximately two (2) pounds of carbon per gallon of water.

### **12.2 Specifications for Virgin Carbon**

The specifications for the virgin carbon supplied for the initial fill shall be delineated in Appendix 2.0.

### **12.3 Installation of Granular Activated Carbon**

Following satisfactory hydrostatic testing of the system, each adsorber vessel shall be filled with 20,000 pounds of virgin granular activated carbon in accordance with appended specifications.

System supplier shall deliver granular activated carbon in trailers suitable for the transport of granular activated carbon. Trailers should be thoroughly cleaned prior to filling with granular activated carbon and shall be constructed with materials suitable for transporting granular activated carbon.

Water required to slurry carbon shall be water provided from a connection on the system as shown on P&ID. The system supplier shall provide the necessary hoses with the system for using this water.

Granular activated carbon initial fill can be transferred as a water slurry using air pressure on the trailer as the motive force. Use of a pump or eductor to transfer the carbon from the trailer into the adsorber vessel will not be allowed. Bag loading or dry loading of the granular activated carbon into the adsorber will not be permissible for the initial fill. The granular activated carbon shall be loaded into the trailers before the trailers are driven onto the site.

The system supplier will be responsible for clean up of all granular activated carbon and slurry spills that may occur during the granular activated carbon transfer operation.

Following installation of granular activated carbon in all adsorber vessels, the system supplier shall assist the client's operating personnel in placing the system in initial operation and training the client's personnel.

### 13.0 SPENT CARBON REACTIVATION

When the client has determined that the adsorptive capacity of the granular activated carbon in the lead bed has been reached, the client will notify the system supplier that the spent activated carbon needs to be replaced. The supplier will schedule the necessary transportation equipment to remove the spent carbon for "thermal segregated off-site reactivation". Procedures and requirements for removal and reactivation of spent granular activated carbon shall be as follows:

- Removal and transportation of the spent carbon shall be in accordance with all applicable local, state and federal regulations. It will be the client's sole responsibility to determine whether the spent carbon is to be categorized as a manifested hazardous waste. If manifested the supplier will ensure that trailers are properly placarded and that properly licensed haulers with statutory minimum insurance are utilized to transport the spent carbon.
- The spent carbon generated by client will at all times be the property of the client and the spent carbon will not be mixed with any other carbon prior to reactivation. Client's carbon will be segregated and processed individually and returned for reuse and re-filling into the system after reactivation.
- Make-up carbon to compensate for attritive losses will be added by supplier to the reactivated product at the reactivation plant. Only virgin carbon make-up is to be added to the reactivated product.
- All carbon delivered to the client will be dry with no more than 2% moisture. Under no circumstances will carbon be delivered wet to client. Carbon will be delivered in 20,000 pound lot size dry basis in lined bulk hopper type trailers.
- Supplier will provide technical training during the first carbon replacements protocol.
- The quality of reactivated carbon will be warranted after supplier has performed a test reactivation on a representative two quart sample of spent carbon. Supplier will supply analytical data to confirm quality of reactivated carbon supplied.
- The supplier will maintain the necessary statutory insurance required for storage of hazardous spent carbon and shall have the required permits to reactivate spent carbon.
- The spent carbon prior to removal for reactivation will be rinsed by client with a minimum of two bed volumes of clean water to remove residual groundwater in the carbon pores.
- System supplier will supply the license and permit number of the hauler and the RCRA identification number of its reactivation plant.

## 14.0 SUBMITTALS

Upon successful award of contract, supplier must submit the following information within a reasonable time frame.

14.1 Submit to the engineer for approval shop drawings showing details of fabrication and installation of all materials and equipment and the system furnished. Include the following:

- Project schedule indicating submittals, equipment delivery, installation and start-up.
- Flow schematic drawing indicating line sizes, valving, utility lines sizes and connections.
- Shop inspection procedure and schedule.
- Linings and surface preparation.
- Seismic analysis (if pertinent) as anchor bolt requirements. Equipment arrangement and weights, detailed drawing(s) and listing of all required anchor bolts and nuts and a dimensional setting plan to conform to the requirements of the furnished equipment.
- Piping and vessel arrangement drawings or plans and elevations including detail and location and required interface connections to be made by others, dimensions, and space requirements.
- Bill of materials and specifications for all supplied equipment and specifications for initial fill of carbon.
- List of any extra materials or supplies supplied with equipment.
- List of recommended spare parts.
- List of any special tools required.
- Equipment line tagging and identifications.
- Two operating and maintenance manuals incorporating all necessary information from previous submittals. Operating section shall include: complete instruction on unloading spent carbon and loading fresh virgin grade carbon, including any auxiliary utilities required; maintenance requirements; typical operation and backwash procedures and valve states; identification of potential operation and maintenance problems; and instructions for troubleshooting the system.

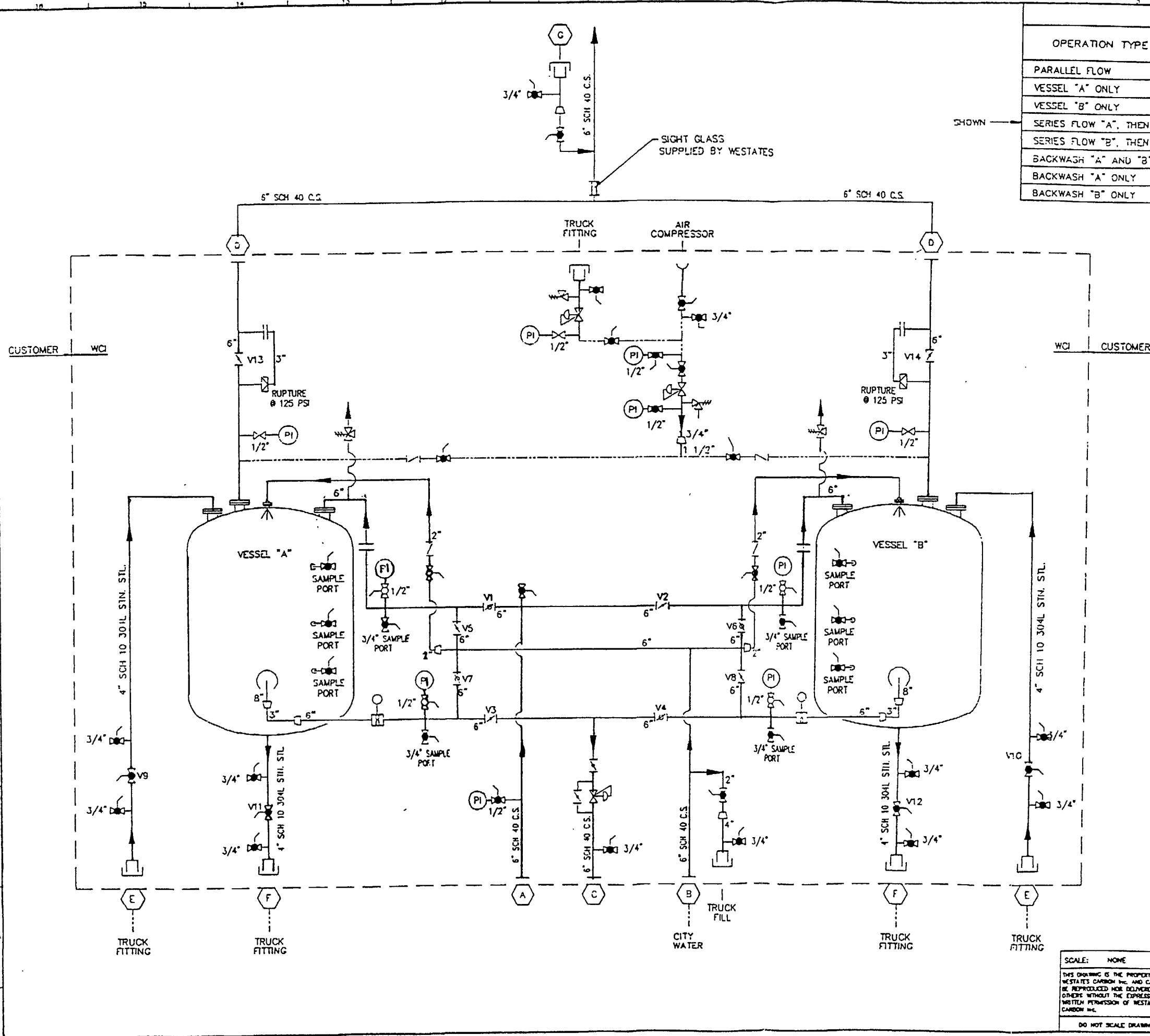
- Names, functional titles, addresses and telephone numbers of technical personnel available for ongoing technical support.
- Complete set of as-built drawings and final bill of materials.
- Manufacturer's data sheet for all adsorber vessels.
- Pressure test report and certificates of inspection for each vessel in accordance with procedures for ASME rating and ASME boiler and pressure vessels code. Reports shall be furnished not later than the time of delivery of the vessels.
- Submit factory test results and inspection reports for all factory applied linings and coatings, including records of film thickness and holiday testing, indicating that all linings and coats have been applied in accordance with the specifications.

## 15.0 MINIMUM QUALIFICATIONS

- Potential bidders must meet the following minimum qualifications and evidence of which will be furnished with the bid or proposal.
- The GAC equipment supplier must be a company with at least ten (10) years experience in the design, procurement, fabrication, installation and operation of liquid phase GAC systems
- The GAC equipment supplier must own and operate an EPA, RCRA permitted spent carbon reactivation plant.
- The GAC equipment supplier will furnish client with ten (10) references for liquid phase GAC systems wherein the supplier has supplied the GAC system and spent carbon reactivation services. Reference will include name of installation, type of contaminants removed and phone number of client and/or consultant
- The GAC equipment supplier will supply client with the resumes of project personnel that will be assigned to the project as well as corporate capabilities for technical analytical and service support
- The GAC equipment supplier will provide documentation pertaining to the type of bulk carbon transport trailers that will be utilized to deliver fresh carbon and transport spent carbon from the facility
- The GAC equipment supplier will provide client with the following information:
  - Transporter EPA ID No.
  - Reactivation facility ID No.
  - Certificate of insurance coverage for reactivation facility evidencing 2.0 Million dollars of sudden and accidental pollution liability coverage
  - Certificate of insurance from transporter evidencing statutory sudden and accidental insurance coverage
- The GAC equipment supplier will supply a system equivalent to Westates Carbon Model LPHP-20 or approved equal.

## **Appendix 1.0**

### **P&ID GAC System Suppliers Scope of Work**



FLOW SEQUENCE / VALVING														
OPERATION TYPE	VALVE NUMBER													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
PARALLEL FLOW	0	0	0	0	C	C	C	C	C	C	C	C	C	C
VESEL "A" ONLY	0	C	0	C	C	C	C	C	C	C	C	C	C	C
VESEL "B" ONLY	C	0	C	0	C	C	C	C	C	C	C	C	C	C
SERIES FLOW "A", THEN "B"	0	C	C	0	C	0	0	C	C	C	C	C	C	C
SERIES FLOW "B", THEN "A"	C	0	0	C	0	C	C	0	C	C	C	C	C	C
BACKWASH "A" AND "B"	C	C	C	C	C	C	0	0	C	C	C	C	0	0
BACKWASH "A" ONLY	C	C	C	C	C	C	0	C	C	C	C	C	0	C
BACKWASH "B" ONLY	C	C	C	C	C	C	C	0	C	C	C	C	C	0

CONN. POINT	CONNECTION SCHEDULE		
	SIZE	TYPE	FUNCTION
A	6"	150 LB. FLG.	INLET
B	6"	150 LB. FLG.	BACKWASH INLET / SPRAY WASH
C	6"	150 LB. FLG.	OUTLET
D	6"	150 LB. FLG.	VENT / BACKWASH OUTLET
E	4"	COUPLING	CARBON FILL
F	4"	COUPLING	CARBON REMOVAL
G	4"	COUPLING	TRUCK DEWATERING

LEGEND	
SYMBOL	DESCRIPTION
	BUTTERFLY VALVE, CLOSED
	BUTTERFLY VALVE, OPEN
	BALL VALVE, CLOSED
	BALL VALVE, OPEN
	RUPTURE DISK
	PRESSURE INDICATOR
	SPRAY NOZZLE ASS'Y
	CHECK VALVE
	FLOW TOTALIZER
	BACK PRESSURE REGULATOR
	TEMPERATURE INDICATOR
	SIGHT GLASS
	AIR VACUUM RELIEF

REV.	DATE	REVISION DESCRIPTION	DFT.	CHK.	ENGR
CUSTOMER					
LOCATION		WESTATES CARBON LOS ANGELES, CA 90040			
TITLE		HP-20 LOW PROFILE ADSORBER P & I D			
DATE	J.M.B.	08/23/93	CODE	CA	DWG. No. PROPOSAL
CHK'D					REV.
ENGR			PROJECT No.	PROPOSAL	SHEET 1 OF 1

SCALE: NONE

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DATE: 08/23/93  
FILE NAME: PROPOSAL

**Appendix 2.0**

**Virgin Carbon Fill  
Specifications  
40,000 Pounds**

## Appendix 2.0

### Virgin Carbon Specifications

Base Material	Bituminous or Sub-Bituminous Coal	
Iodine Number	Minimum	900
Abrasion Number	Minimum (Ro-Tap Method)	75
Moisture	Maximum Percent	2
Water Soluble Ash	Maximum Percent	1.0
Particle Size	U.S. Sieve Size	8 x 30
Oversize (Greater than 8 Mesh)	Maximum Percent	15
Undersize (Less than 30 Mesh)	Maximum Percent	5
Mean Particle Diameter	Millimeters	1.5-1.7
Effective Size	Millimeters	0.8-1.0
Apparent Density (Before Backwashing) (After Backwashing)	lbs/cu. ft. lbs/cu ft. minimum	28-32 27-38
Total Ash	Maximum Percent	15%
Uniformity Coefficient	Maximum	2.0

## LPHP-20 HIGH PRESSURE ACTIVATED CARBON ADSORPTION SYSTEM

Westates standard model LPHP-20 high pressure system consists of dual vessels, complete with inlet distribution, underdrain collection system, and face piping for series lead/lag and parallel flow configuration.

### System Parameters

Series GPM:	Maximum 750 8-10 PSID @ 14.2 min. EBCT
Parallel GPM:	Maximum 1,300 @ 4-5 PSID @ 7.1 min. EBCT
Number of Vessels:	2
Media, type:	Granular Activated Carbon
Quantity per vessel:	20,000 lbs.
Vessel Diameter:	138"
Straight Side:	60"
Design Working Pressure:	125 psig @ 150°F
Material of Construction:	Carbon Steel-ASME Code Section VIII, Div. 1
External Surface:	Epoxy coating- 6 mil DFT
Internal Surface:	Plasite 4110 Vinyl Ester 35-40 mil DFT - FDA Approved
Vessel Supports:	Structural Steel Legs and Skid
Face Piping:	Sch. 40, Carbon Steel, 6"
Underdrain System:	316 Stainless Steel Vertical Screens
Service Connections:	6" Flanged Inlet/Outlet
Access Opening:	20" Hinged Manway
Carbon Fill/Removal:	4" Flange
Backwash/Vent:	6" Flange
Backwash:	Manual
Shipping Weight:	48,000 lbs. (Approximate)
Operating Weight:	253,000 lbs. (Approximate)
Overall Height:	162"
Overall Width:	360"
Overall Depth:	174"
Auxiliaries (included):	Pressure Gauges, Sample Taps, Bed Sample Port and Spray Nozzle
Process Valve:	Epoxy Coated Cast Iron
GAC Fill/Discharge:	Stainless Steel Full Bore Ball

Note: EBCT - Empty Bed Contact Time based on a carbon density of 28.0 lb/cu.ft.